Thesis for the Degree of Doctor of Medicine

PREVALENCE AND MORTALITY OF WHOOPING COUGH IN ABERDEEN FROM 1882 - 1900

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THESIS FOR THE DEGREE OF DOCTOR OF MEDICINE.

PREVALENCE AND MORTALITY OF WHOOPING COUGH IN ABERDEEN FROM 1882 TO 1900.

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Whooping Cough, as is generally known, is one of the most widely prevalent, and one of the most fatal of the commoner infectious diseases, and any fresh in-vestigation of its attack-incidence and mortality ma I hope, be welcomed.

It is only within comparatively recent years, si the introduction of the compulsory notification of in-fectious diseases, that records of the incidence of these diseases have become available.

Under the Notification Act of 1889 Whooping Coug is not included in the list of notifiable diseases, a -though there is power given to any Local Authority t add it. But exceedingly few Authorities have taken advantage of this power.

Aberdeen obtained, under the Corporation Act of 1881, power to compel the notification of all the pri -cipal infectious diseases, inclusive of Whooping Cou and since the commencement of 1882, there exists for the City a complete record of all the cases of Whoopi Cough notified to the Medical Officer of Health.

Statements are to be found in the works of vario authorities as to the prevalence of Whooping Cough in so far as it can be judged from an examination of the recorded deaths from the disease, but I am not aware that/

that, hitherto, there has appeared any sufficient statement of the incidence, and other points in relation to Whooping Cough, as determinable from notified sicknesses.

I have, therefore, at the suggestion of Professor Hay, Medical Officer of Health for the City, undertaken a study of the records of Whooping Cough in Aberdeen, the results of which I now venture to submit.

Of course it is to be borne in mind that the following paper can deal only with notified cases. No doubt several cases escape notification but the number escaping is not believed now-a-days to be large. I may have some observations to make later on in regard to this point, so far as concerns the earlier notifications. The record, therefore, is not an absolutely complete record of all the cases, but it is probably sufficient for such purposes as the present, and is, in any event, the fullest that is obtainable.

1. INCIDENCE. (MORBIDITY).

A. In respect of time and season.

B. In respect of age and sex.

C. Second Attacks.

A. In/

A. In respect of time and season.

In Aberdeen since the commencement of the year 1882 up to the end of 1900 altogether 20,405 cases of Whooping Cough have been notified, and it is with these cases that the following data are concerned.

1. General progress of case-incidence since notification began.

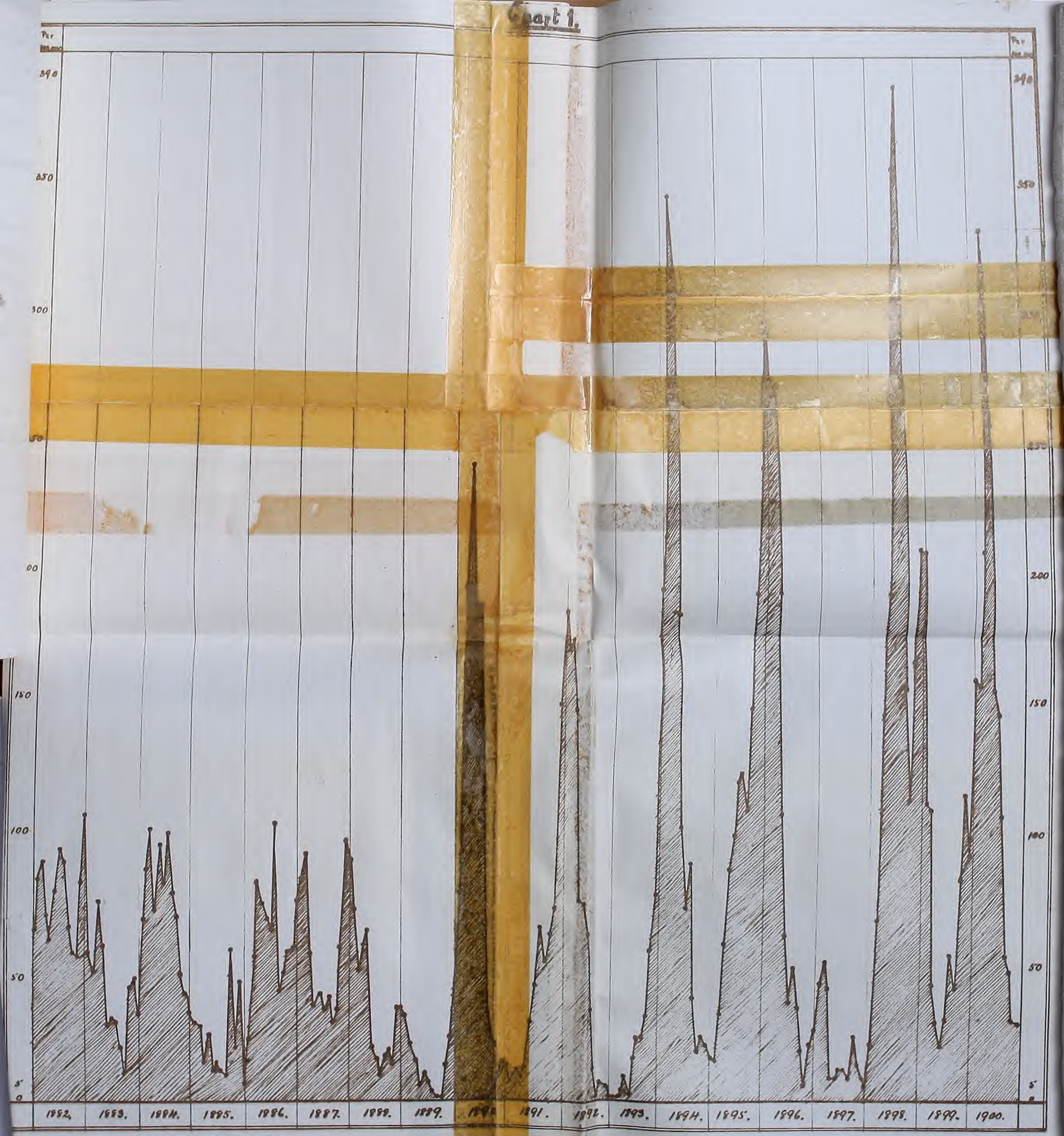
The accompanying chart (No. 1) exhibits in graphic form the monthly attack-incidence of Whooping Cough since 1882, the cases being stated as per 100,000 of population, in order to eliminate the effect on the diagram of the considerable growth of population during the period.

It will be observed:-

(a) That the disease seems to have become distinctly more prevalent in Aberdeen during the past 10 years, than it was in the years 1882-1889.

(b) That the rhythm or periodicity of its incidence has altered. In the 1890-1900 period Whooping Cough appeared in epidemic form with wonderful regularity every two years. This rhythmic swing is only slightly marked in the 1882-1889 period. It may be that more complete/

Chart 1.



WHOOPING COUGH.— Case-Incidence per 100,000 of Population in each month from 1882 to 1900, (19 years). Chart 1.

complete notification since 1889, (when dual notifi-ion came into force), partly accounts for this app difference in type. A chart (No. 6), showing the from Whooping Cough per 100,000 of population durin same period (1882-1900), presents a closely similar appearance, and this fact rather goes to prove that there has been a true change in the periodic incide of the disease.

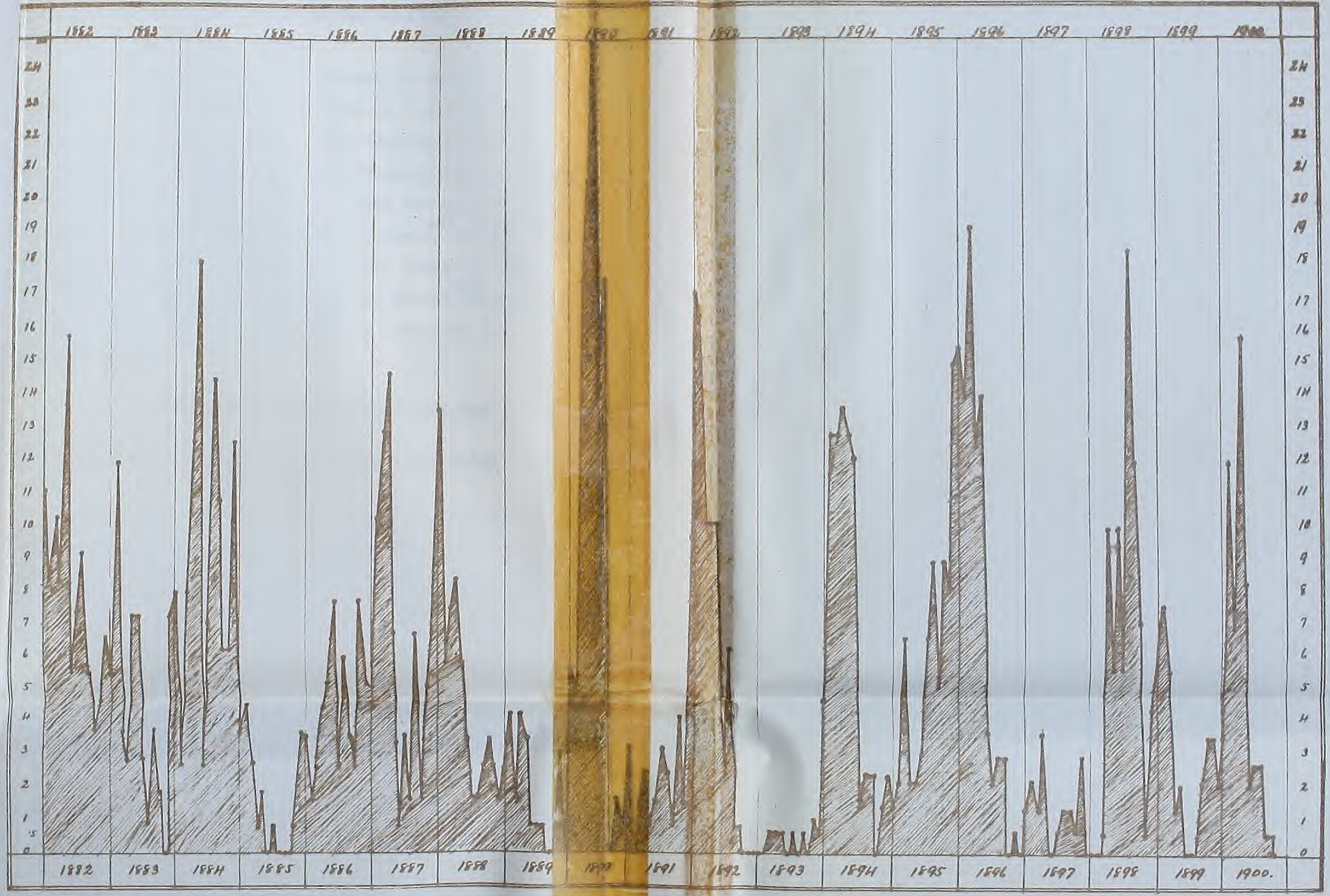
(c) The average interval between the peaks indicat the height of the epidemics is exactly 24 months, a among the well-marked epidemics since 1890, the sho -est interval is 20 months and the longest 31 month

The epidemic of 1898, which follows this longe interval, is the largest, in point of number of cas notified, which has occurred in Aberdeen since noti -ation came into force. This is doubtless account for by the accumulation of a large number of suscep -ible persons (children) since the preceding epidem

(d) All the well defined epidemics reach their hig point in the first quarter of the year with the exc of the epidemic of 1898, which had its highest poin August, and which may be looked upon as being a "de epidemic.

2. Incidence in relation to season.

Chart 6.



WHOOPING COUGH – Deaths per 100,000 of Population in each month of the year from 1882 to 1900 (19 years)

In the accompanying diagram (No. 2) there is represented in graphic form the average attack-incidence of Whooping Cough per 100,000 of population in each of the 12 months of the year, based on the notification returns for the 12 years ending 1900.

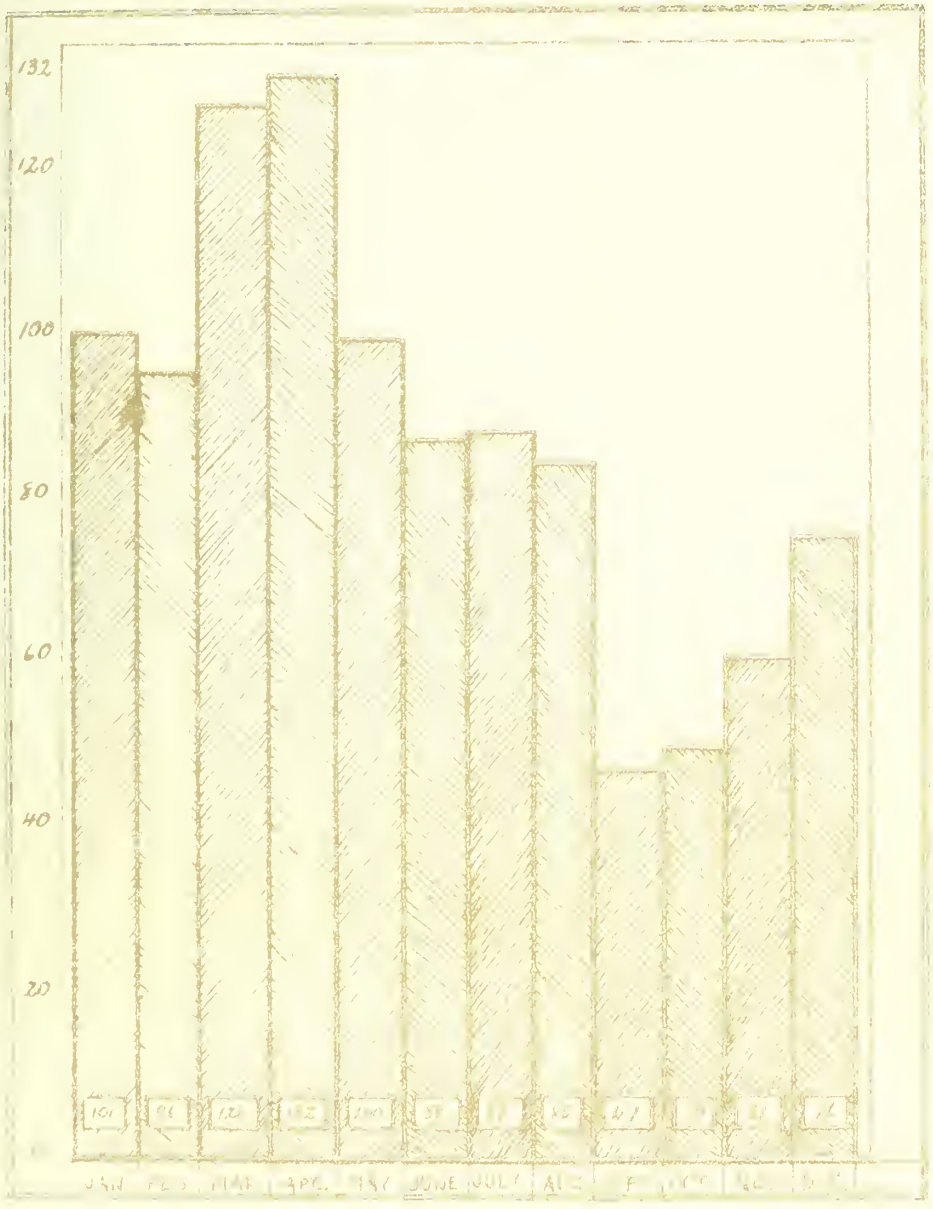
It will be seen that the disease is most prevalent during the spring months, and least so in the autumn months of the year. April, (132), closely followed by March, (128), shows the maximum prevalence, and September, (47), closely followed by October, (50), the minimum prevalence. January,(93) February, March, April,(132) and May(104) have more than the average number of cases, (which is 88). June(84) and July(84) have an average number. August,(75) September, October, November,(61) and December(76) have less than the average number.

B. INCIDENCE IN RESPECT OF AGE AND SEX.

1. Incidence in respect of age (the sexes being combined).

Chart 3 shows graphically the attack-incidence of Whooping Cough per 1,000 of population living at different ages. The years are given individually up to the age of 15 years. Above that age the cases are arranged in/

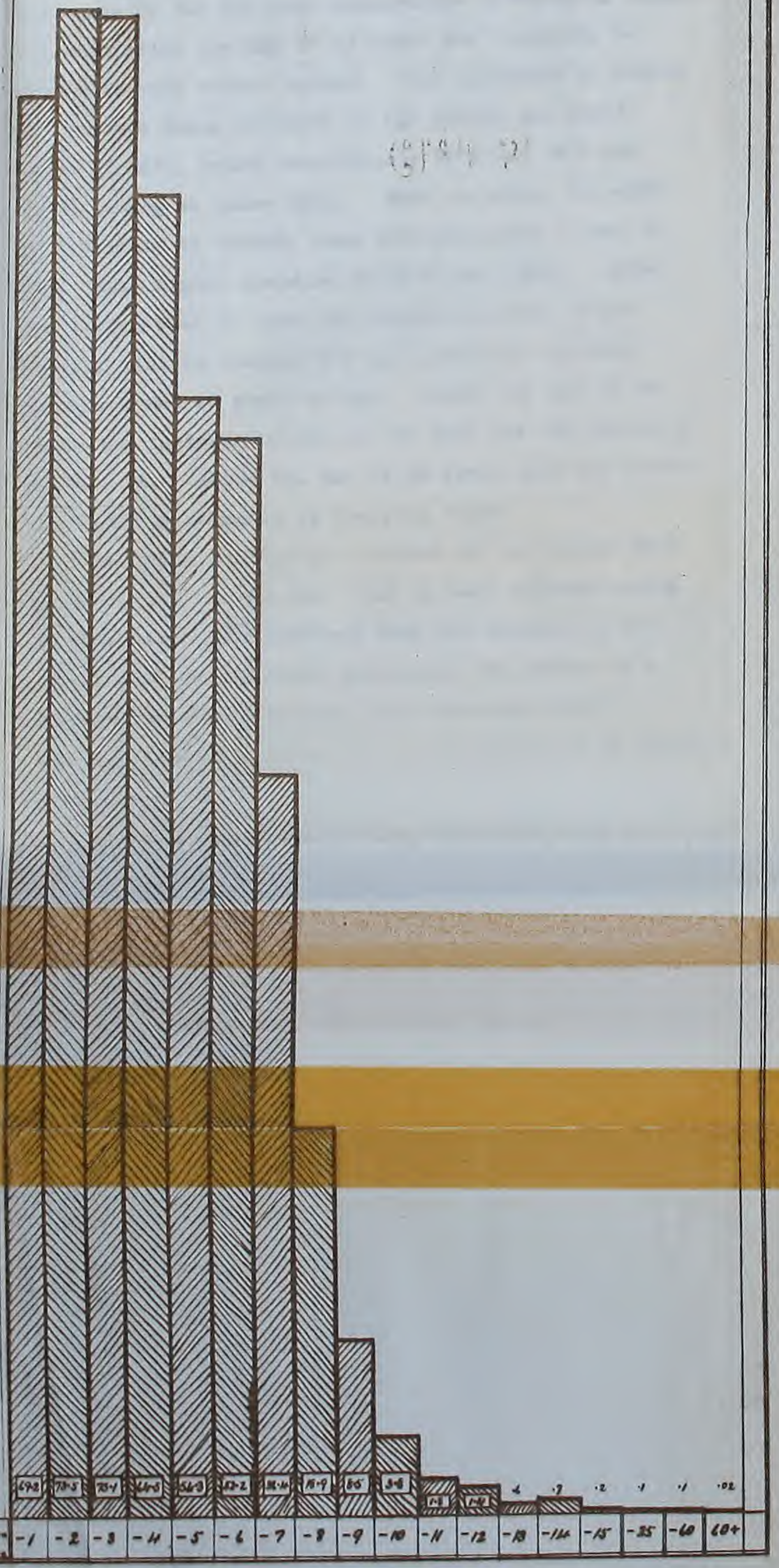
Chart 2.



Whooping Cough – Case Incidence per 100,000 of Population

in each of the twelve months of the year (average of 10 years)

Chart 3.



2492	2327	2297	2129	1808	1676	1163	584	366	114	58	43	21	21	7	42	45	2

Number of cases dealt with at each age.

Whooping Cough – Case-Incidence (being the attacks per 1000 of Population at each age.)

in 3 groups, the age-periods being, 15-35 years, 35-60 years, and 60 years and over. This chart makes no dis-tinction between the sexes.

It will be seen that children under the age of 4 years are by far the most susceptible to Whooping Cough, and that after the age of 10 years the liability to attack is very slight indeed. The incidence of attack is heaviest among children in the second and third years of life, being respectively 73·5 and 73·1 per 1,000 living at those ages. Next in order, in point of liability to attack, come children under 1 year of age, their figure standing at 69·2 per 1,000. After the fourth year of life the attack-incidence falls rapidly till it reaches 3·3 per 1,000 for children between 9 and 10 years of age. Above the age of 15 years the incidence falls so low that one can afford to neglect it. Above the age of 60 years only one person in 50,000 is attacked by Whooping Cough.

The small liability to attack at the higher ages is partly due to the fact that so many persons living at those ages have suffered from the disease as chil-dren, and are therefore protected, and partly to a diminishing susceptibility with advancing years. One must, therefore, allow for the accumulation of protected survivors/

survivors, before any assumed average susceptibility at the higher ages can be inferred.

2. Incidence in respect of age (the sexes being taken separately).

Chart 4 deals with the attack incidence of Whooping Cough in respect of both age and sex. It will be observed that the liability to attack is constantly higher among females than among males. The only exception to this rule is at the 14-15 age period, and here the difference is so slight (·1 in 1,000) as to be scarcely worth considering.

Among males the liability to attack is greatest in the second year of life, the rate of incidence being 68·6 per 1,000. Next in order come the third and first years of life with 66·5 and 65·7 per 1,000 respectively. After the age of 3 years the attack incidence falls rapidly, and after 15 years it practically disappears. In the age-period above 60 years no male is recorded as having had Whooping Cough during the 10 years under consideration.

Among females the susceptibility towards Whooping Cough is greatest, (80·8 per 1,000), in the third year of life, as contrasted with the second year of life in the case of males (with 68·6 per 1,000). The next in order of liability to attack in the case of females is the second year with 79 per 1,000. Then come the

Chart 4.

Males	1257	1114	1128	1010	547	536	361	285	105	54	25	17	8	8	4	7	10	-	
Females	1235	1213	1169	1119	461	540	602	296	161	60	31	26	13	13	3	35	35	2	

Number of cases dealt with at each age and in each sex.

WHOOPING COUGH – Case-Incidence (being the numbers attacked per 1000 of Population at each age and for each sex)

first and fourth years with 73·6 and 70·9 per 1,000 respectively. As in the case of males, the liability to attack is very slight after the age of 15 years. Two females above 60 years of age are recorded as having had Whooping Cough during the period under consideration (1891-1900).

ASSOCIATION OF WHOOPING COUGH & MEASLES.

Most writers assert that there is an intimate association between epidemics of Measles and epidemics of Whooping Cough, and it is widely believed that the existence of the first disease strongly predisposes to the later development of the second.

In order to see if any such relationship between the diseases exists in the case of Aberdeen, I have prepared a diagram (No. 5) in which the monthly notifications of the two diseases per, 100,000 of population since 1882 are graphically represented. The red line represents Measles and the purple line Whooping Cough.

If an attack of Measles predisposes to Whooping Cough, one would expect to find the latter disease following closely on an epidemic of the former, and that, in the chart, the line representing the decline of/

Chart 5.

Case-Incidence of WHOOPING COUGH and MEASLES per 100,000 of Population in each month from 1882 to 1900 (19 years).

of the Measles epidemic would be overlapped by the ascending line representing the rising epidemic of Whooping Cough. This is seen in only one instance during the period represented in the diagram. It will be observed that the Measles epidemic of 1894--95 is overlapped in its decline by the rising Whoop--ing Cough epidemic of 1895.

Again, if Measles predisposes to Whooping Cough, the space separating the peak of one epidemic of Measles from the peak of the following Whooping Cough epidemic ought to be narrower than the space between one epidemic of Whooping Cough and the next of Measles. Quite the reverse of this is seen in the diagram. The interval separating Whooping Cough from Measles is shorter than that separating Measles from Whooping Cough. In the one case the interval is 8·6 months, in the other 14·8 months. From this it would seem as if Whooping Cough rather paved the way for Measles, than Measles for Whooping Cough.

C. SECOND ATTACKS.

Second attacks of Whooping Cough are known to be of somewhat rare occurrence, though in what proportion they occur has not, hitherto, been definitely deter--mined.

The subjoined table deals with second attacks among cases notified during the 10 years ending 1900. The table shows the total number of cases, the number of second attacks among these, and the proportion of second attacks per 1,000 cases. In the table the numbers for each sex, and for the combined sexes are given, and also the numbers at different age-periods.

It will be observed that the proportion of sec--ond attacks to total cases rises steadily with in--crease of age. Thus, for the four age-periods given in the table for the combined sexes, the fig--ures are ·45, 7, 23·8, and 127·6 per 1,000 respect--ively.

It will also be observed that males suffer less frequently from second attacks than females. This applies to all ages taken together and to the differ--ent age-periods. Thus, among 1,000 cases at all ages among males the proportion of second attacks is only 1.5, while among females the proportion is 3·7 per 1,000.

No third attacks are recorded.

TABLE α.

(Second Attacks)

Age Periods	MALES			FEMALES			BOTH SEXES		
	Total No. of Cases	Number of 2nd Attacks	2nd Attacks per 1000 cases	Total No. of Cases	Number of 2nd Attacks	2nd Attacks per 1000 cases	Total No. of Attacks	Number of 2nd Attacks	2nd Attacks per 1000 cases
0-5 years	5356	0	0	5697	5	·9	11,053	5	·45
5-15 "	1905	10	5·2	2047	18	8·8	3952	28	7
15-25 "	7	0	0	35	1	28·5	42	1	23·8
25+ "	10	1	100	37	5	135	47	6	127·6
ALL AGES.	7278	11	1·5	7816	29	3·7	15,094	40	2·6

2. MORTALITY.

A. In respect of time and season.

B. In relation to morbidity.

C. In respect of age and sex.

D. In relation to different sizes of houses.

E. Comparison of Aberdeen with the other chief towns of Scotland.

A. MORTALITY IN RESPECT OF TIME AND SEASON.

1. General progress since 1882.

In Chart 6 the death-rate per 100,000 of population in each month of the 19 years ending 1900 is graphically shown.

It will be seen that this chart bears a close resemblance to chart 1, which deals with the morbidity, or the number of attacks per 100,000 of population during the same period.

Although the mortality rate runs to greater heights in the 1890-1900 period, owing to the occurrence of well-marked epidemics, yet the spaces indicating a low rate of mortality are deeper and wider in this period than in the 1882-1890 period. The average annual mort-ality for the earlier period is 67·7 per 100,000 of population, while in the later period it is 53·6 per 100,000 — a reduction of fully one-fifth.

Chart 7 represents graphically the progress of case-mortality from 1888 to 1900. The deaths occurr-ing in each quarter of the year are stated as a per-centage of the cases notified in the same quarter. In the same chart there is a line, in purple, repres-enting the incidence of attack per 10,000 of popul-ation in each quarter.

It will be observed that, while the proportion of persons attacked by Whooping Cough has become greater in recent years, the case-mortality has fallen very decidedly. The average case-mortality for the years 1882-1890 was 10·5%. The average for the years 1890-1900 was 5·3%, or almost exactly half of the case-mortality for the earlier period.

The case-mortality during the last three years is exceptionally low, only once rising above 4%.

2. Case-mortality in relation to season.

Chart 8 shows graphically the percentage mortal-ity among cases notified in the different months of the year. It deals with 16,723 cases and 886 deaths, which occurred during the years 1888-1900.

It will be seen that the case-mortality is con-siderably higher in the earlier months of the year than in the later.

1892 1893 1894 1895 1896 1897 1898 1899 1900

90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0

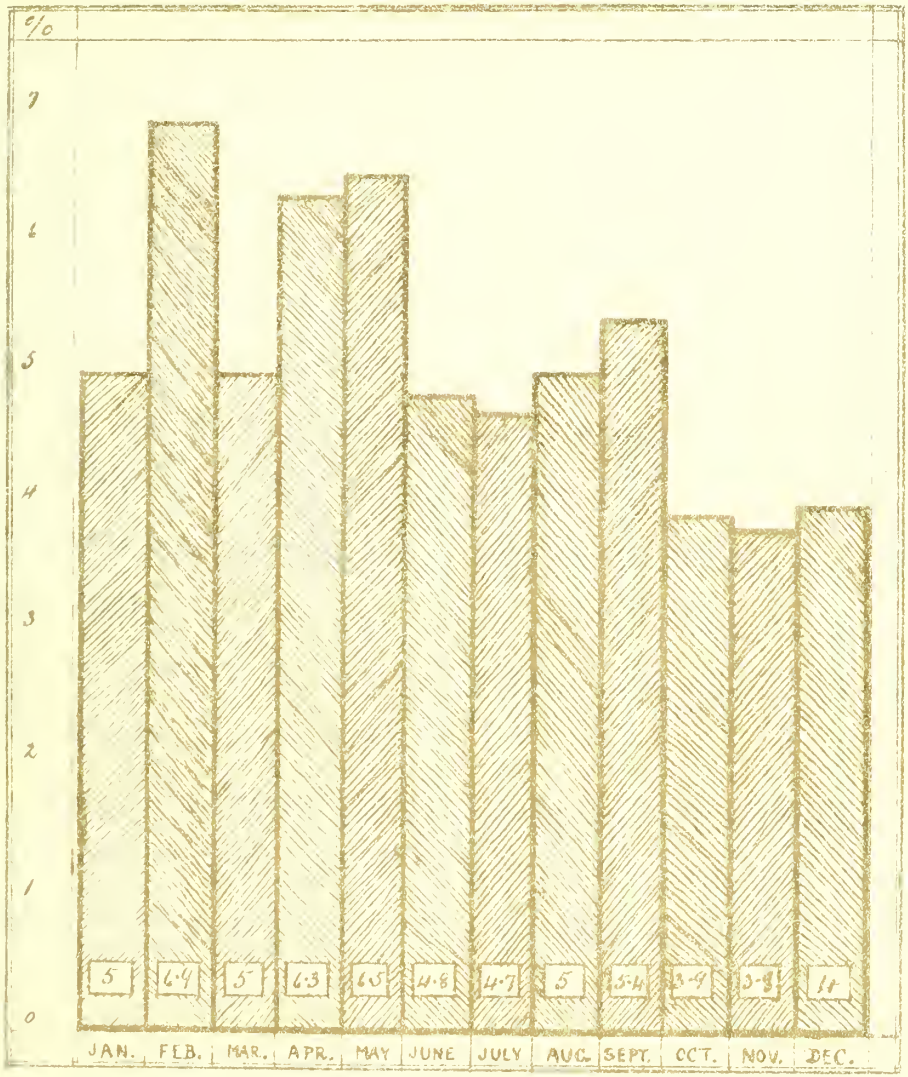
INCIDENCE

MORTALITY

Chart 7.

WHOOPING COUGH – Mortality, (being the deaths per 100 cases notified), and Incidence, (being the cases notified per 10,000 of Population), in each quarter of the year from 1892 to 1900, (19 years)

Chart 8.



CASES.	1628	1524	2028	2092	1882	1340	1407	1361	758	787	956	1210.
DEATHS.	82	104	102	133	103	67	67	68	41	31	37	49.

Number of cases and deaths dealt with in each month.

WHOOPING COUGH.- Mortality, (being the deaths per 100 cases notified) in each month.—Average of 12 years.

There appear to be two maxima and two minima. The maxima are in Spring and Autumn, with February (6·9%) and September (5·4%), as their highest points respectively. The minima are in Summer and Winter, with July (4·7%) and November (3·8%) as their lowest points.

The mortality is highest, namely 6·9%, among cases notified in February, and is lowest, namely 3·8% in November, being closely followed by October with 3·9%.

In the months of February (6·9%), April (6·3%), May (6·5%), and September (5·4%) the case-mortality is above the average (5·3%); whilst in January (5%), March (5%), June (4·8%), July (4·7%), August (5%) October (3·9%), November, (3·8%), and December (4%), it is below the average.

B. CASE-MORTALITY IN RELATION TO MORBIDITY.

On referring to Chart 7, which shows both quarterly case-mortality and quarterly attack-incidence per 10,000 of population, it will be seen that, in a general way, a high incidence is associated with a low, but rising case-mortality; whereas a low incidence is associated with a high, but falling case-mortality.

C. CASE-MORTALITY IN RESPECT OF AGE AND SEX.

1. In respect of age, (the sexes being combined).

Diagram 9 represents graphically the deaths from

Chart 9.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	25	60	60+	All Ages
Cases	342	765	855	644	2492	2327	2297	2129	1809	1671	1163	584	266	114	56	43	21	21	7	42	45	2	15 094
Deaths	12	90	55	13	313	235	76	45	30	9	8	1	1		-	-	1	-	-	-	-	-	778

Number of cases and deaths dealt with at each age.

Whooping Cough – Mortality (being the deaths per 100 cases notified), at each age, from 1891 to 1900, - average of 10 years.

Whooping Cough per 100 cases at all ages, and at dif-
-ferent ages, males and females being considered to-
-gether. The case-mortality is shown for each year
of life up to the age of 15 years. Above the age of 15
years the cases are arranged in three groups, the age-
-periods being 15-25 years, 25-60 years, and 60 years
of age and upwards. The first year of life has been
subdivided to show the case-mortality in each of its
four quarters.

Dealing first with the case-mortality for all ages
taken to-gether, it will be seen that it stands at 4·7%.
This applies to the 10 year period ending 1900. Anter-
-ior to this time it will be recollected that the general
case-mortality stood considerably higher.

Coming next to the case-mortality at different
ages, it is clearly seen that the first and second
years constitute the period of life in which Whooping
Cough is most fatal, the rates for these years being
12·5% and 10·1% respectively.

In the third year of life there is a great fall
in the case-mortality to 3·3%, this rate being a little
more than one-fourth of the case-mortality in the first
year, and less than one-third of that in the second
year of life. After the fifth year very few deaths

from Whooping Cough occur.

One need not attach any importance to the apparently high case-mortality, (4·7%), in the thirteenth year of life, seeing that only 21 cases with 1 death are dealt with at that age.

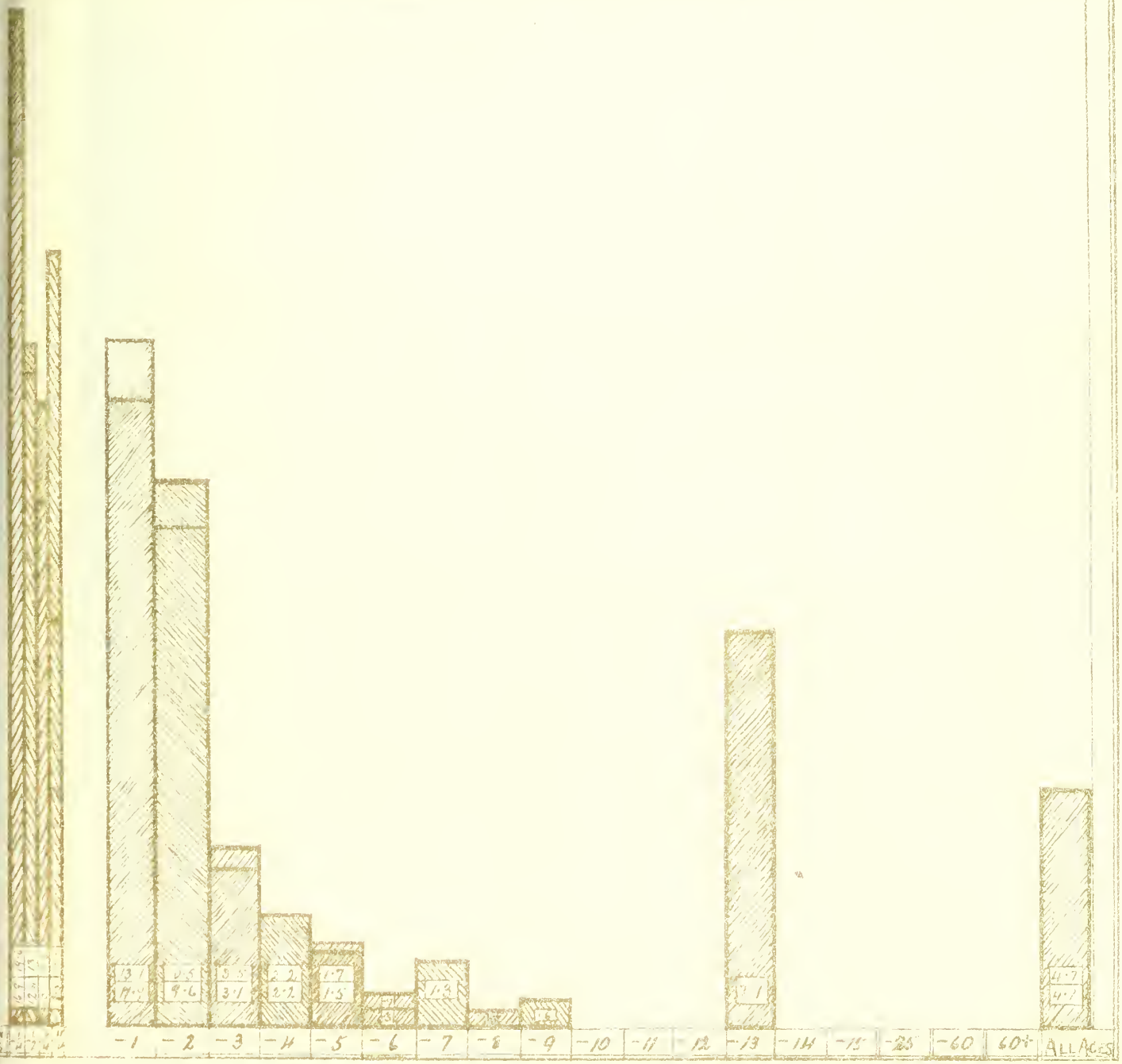
On analysing the case-mortality in the first year of life, one finds that the rate is highest, namely 18·2%, in the first quarter. There is a considerable drop to 12·7% – about the average for the whole of the first year – in the second quarter. The third and fourth quarters stand pretty nearly at the same level, the fourth (11·3%) showing a slightly higher figure than the third (10·9%).

On looking at this table it is obvious that, if children can be protected from Whooping Cough in the first and second years of their life, their chances of recovery, if attacked by the disease, are greatly in-creased.

2. Case-Mortality in respect of age, (the sexes being taken separately).

Chart 10 shows the case mortality of Whooping Cough at different ages, and for each of the two sexes, the male mortality being indicated by purple lines and the female by red lines.

Chart 10.



	1266	1114	22	1046	847	836	561	286	105	54	25	17	8	8	4	7	10	-	727
	165	107	35	23	15	3	-	-	-	-	-	-	-	-	-	-	-	-	348
	1236	1213	111	1119	863	840	602	296	161	60	31	24	13	15	5	33	33	2	1516
	148	128	41	25	15	6	8	1	1				1			-	-	-	374

Number of cases and deaths dealt with at each age and for each sex

OOPING COUGH.—Mortality (being the deaths per 100 cases notified), at each age and for each sex — average of 10 years

The average mortality at all ages, during the period under review, is the same for each sex, namely 4·7%.

As regards the case-mortality at different ages, th for males is higher than the rate for females in the fir and fifth years of life. In the fourth year the rate are equal for the two sexes. In the second, third, and sixth years of life the mortality is higher among female than among males. Above the sixth year, there were no deaths among males, although there were several among females, viz:- at the seventh, eighth, ninth, and thir--teenth years.

The high rate (7·7%) among females in the thirteenth year is got by one death among 13 cases. As the number of cases is so small no importance need, therefore, be attached to it.

With regard to the four quarters of the first year it will be noticed that the case mortality is, for each sex, highest in the first quarter, with a preponderat--ing height for females, for whom the mortality rapidly falls in each succeeding quarter. In the case of the males there is also a rapid fall in the second and third quarters, with, however, a considerable rise in the fourth quarter, so that during this quarter the mortality is

almost twice as high among males as among females.

D. CASE-MORTALITY IN RELATION TO SIZE OF HOUSE.

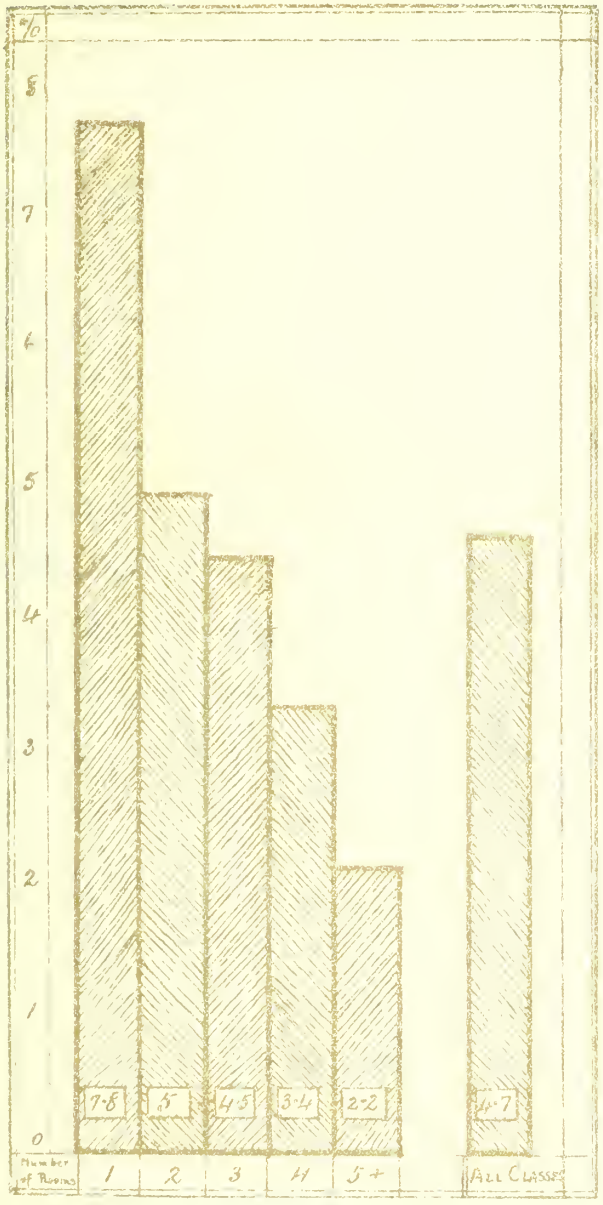
The accompanying diagram (No.11) has been prepared for the purpose of demonstrating the influence of social status on the case-mortality of Whooping Cough. The size of house, as being a fairly accurate indication of social status, forms the basis of classification of the cases.

The cases are arranged in five groups according to the number of rooms in the house in which they occurred, all the cases occurring in houses of five or more rooms being placed together in one group.

The case-mortality among cases in one-roomed houses (7·8%) is greatly in excess of the average for all sizes of houses (4·7%), while in two-roomed houses the rate (5%) is slightly above the average. Cases occurring in three-roomed houses show about the average mortality (4·5%). Among cases from four-roomed houses the case-mortality (3·4%) is distinctly below the average; and among cases from houses with five rooms and upwards the rate (2·2%) is far below the average.

The above figures show that Whooping Cough is three and a half times more fatal to children in one-roomed houses, than to children living in houses of five or more rooms.

Chart 11.



Cases	11711	7364	3831	1074	1334		15,008
Deaths	92	395	174	37	30		718

Number of cases and deaths dealt with in each class of house.

Whooping Cough.– Case-Mortality in different classes of houses. [1882–1901.] Rate %

E. MORTALITY FROM WHOOPING COUGH IN ABERDEEN AND THE OTHER CHIEF TOWNS OF SCOTLAND.

Diagram 12 exhibits, in graphic form, the annual mortality from Whooping Cough per 100,000 of population in the eight chief towns of Scotland, from the year 1857 to the year 1899.

1. It will be observed that in all the towns the mortality per 100,000 of population runs much higher in the earlier years dealt with in the diagram, than in the later. Thus, the average rate per 100,000 of population for all the towns together was 105 in the 1857-1872 period, and only 70 in the 1873-1899 period.

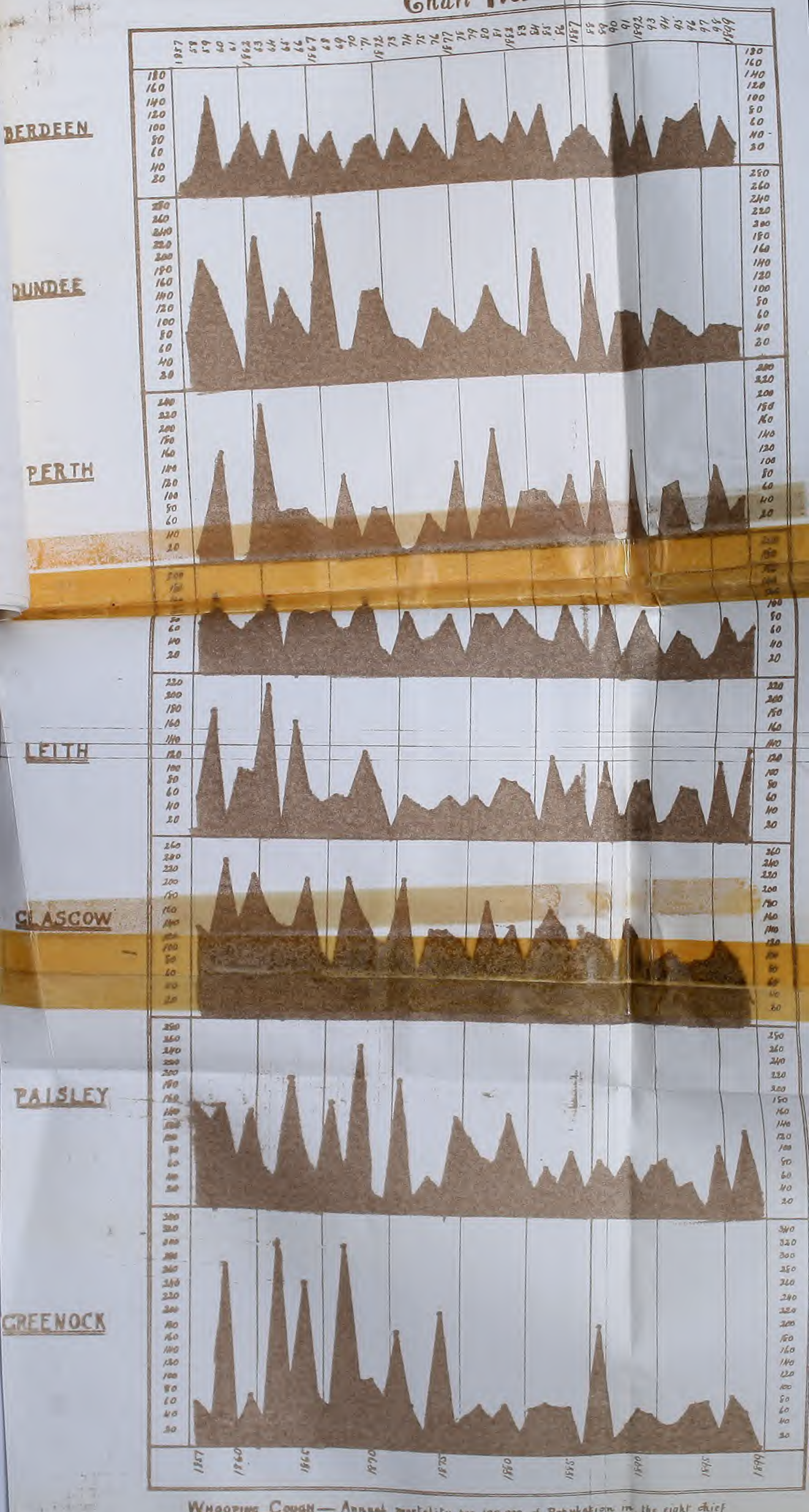
Aberdeen differs from the other towns in showing only a very slight difference in the mortality rate for the two periods. For the earlier period the rate was 65 per 100,000, in the latter it was 63. (See Table β).

Aberdeen is the town which shows the least fluctuation in the mortality rate from Whooping Cough, its highest and lowest rates being 149 per 100,000, (in 185 and 5 per 100,000, (in 1893), respectively.

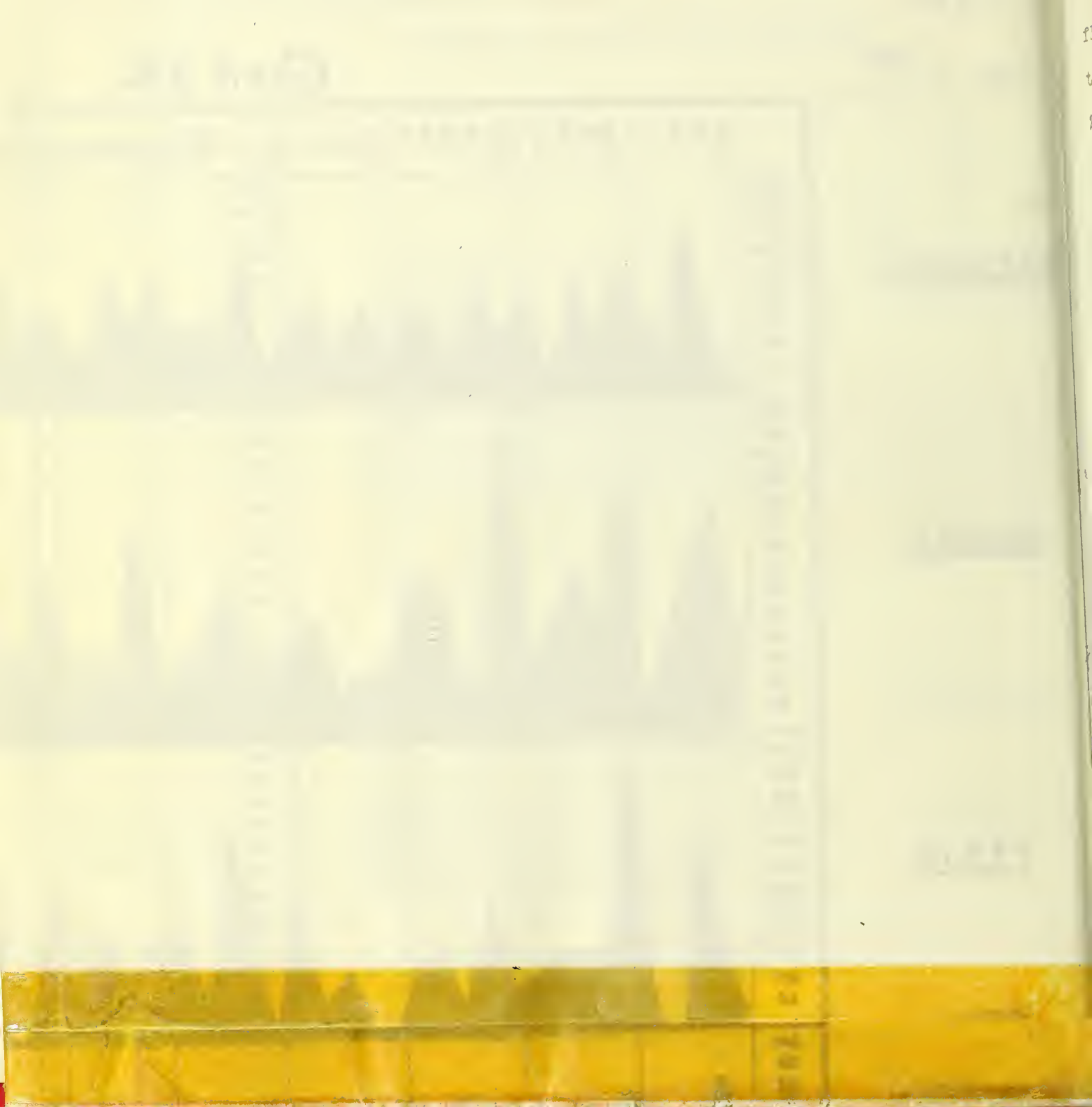
Greenock shows the greatest fluctuation. In the year 1863 its rate was 315 per 100,000, whilst in 1886, it was only 4 per 100,000.

Generally/

Chart 12.



WHOOPING COUGH — Annual mortality per 100,000 of Population in the eight chief Towns of Scotland from 1857 to 1899 (43 years).



Generally speaking, the smaller towns show greater fluctuations in the mortality rate of Whooping Cough, than the larger.

2. It will be observed that high mortality rates occur in several towns in the same year, indicating, in all probability, a simultaneous epidemic prevalence of Whooping Cough in these towns.

Thus in 1858, Dundee, Edinburgh, and Leith show peaks of mortality. In 1859, Aberdeen, Perth, Glasgow, Paisley, and Greenock have high mortality rates. Then in 1862 there was a coincidence of high mortality-rate from Whooping Cough in Aberdeen, Dundee, Perth, Edinburgh and Leith.

The hollows, (Chart 12), representing years in which the mortality-rate is low, also coincide to a certain extent in the different towns.

3. Taking the average mortality-rate over the whole period 1856-1899, it will be seen from Table B that Aberdeen and Perth have the lowest rates, namely 64 and 63 respectively, per 100,000 of population.

Next in order come Edinburgh with 71, Leith with 72, Paisley with 88, Dundee and Greenock with 91, and Glasgow with 131.

Glasgow has, therefore, an annual mortality-rate per/

per 100,000 of population, which is more than twice [illegible] 20
of Aberdeen.

TABLE β.

	1851 - 1872	1873 - 1877	1881 - 1885
GLASGOW	142	112	101
DUNDEE	121	72	91
[illegible]	138	66	87
PAISLEY	112	70	88
LEITH	86	64	78
[illegible]	97	61	71
[illegible]	65	63	69
PERTH	72	57	63
Average of 8 Towns	106.	70.	88.

Average Annual Mortality from Zymotic Causes per 100,000 of Population.

SUMMARY.

The following is a brief summary of the chief points in this paper dealing with Whooping Cough in Aberdeen.

INCIDENCE. (MORBIDITY).

(1) Whooping Cough has become more prevalent in Aberdeen during the past ten years than it was before this period.

(2) The epidemic periodicity has become more marked since 1890 than it was formerly.

(3) Epidemics occur with great regularity once in two years, and follow pretty closely after epidemics of Measles.

(4) The disease is most prevalent in Spring, and least prevalent in Autumn.

(5) Children, (both sexes taken together), in the second year of life show the greatest liability to attack.

(6) After the age of 15 years, the susceptibility towards the disease is very slight.

(7) Males are most liable to be attacked by Whooping Cough in the second year of life, whereas females are most liable to be attacked in the third year of life.

(8) Second/

(8) Second attacks occur in only 2·6 per 1,000 of total cases. They are more common among females, (3·7 per 1,000), than among males, (1·5 per 1,000 cases). Second attacks are more numerous in proportion to tot attacks at the higher ages than at the lower.

MORTALITY.

(9) The mortality from Whooping Cough per 100,000 of pop--ulation has fallen from 67·7 in the 1882-1889 period to 53·6 in the 1890-1900 period.

(10) The average case-mortality, (deaths per 100 cases), for the years 1882-1889 was 10·5%, and for the 1890--1900 period it was 5·3%. During the last three years it has been less than 4%.

(11) Case-mortality shows maxima in Spring and Autumn, Feb--ruary (6·9%) and September (5·4%) being the highest points. There are minima in Summer and Winter, July (4·7%) and November (3·8%) being the lowest points.

(12) In a general way, a high attack-incidence is associat with a low, but rising case-mortality; whereas, a lo incidenc is associated with a high, but falling case--mortality.

(13) The average case mortality for all ages and both sexes during the ten years ending 1900, is 4·7%.

(14) Case-mortality/

(14) Case-mortality is highest in the first year of life, (18·5%), and in the first quarter of the first year (18·2%).

(15) In the second year of life the case-mortality is 10·1 %, and in the third year only 3·3%. At the higher ages it is very low, being 1·2% for all ages above three years taken together.

(16) The average case-mortality at all ages is the same for each sex, namely 4·7%.

(17) In the first and fifth years of life the case-mortality among males, (13·1% and 1·7% respectively), is higher than the mortality among females, (11·9% and 1·5% respectively). In the fourth year the rate is the same for each sex, namely 2·2%. In the second, third, and sixth years of life the mortality is higher among females, (10·5%, 3·5%, and ·7% respectively), than among males, (9·6%, 3·1%, and ·3% respectively).

(18) Case-mortality is affected by social status as deter--mined by the size of house in which the cases occur. Thus, in one-roomed houses the case-mortality is 7.8%, whereas, in houses of five rooms and upwards the mortality is only 2·8%.

(19) The annual mortality-rate per 100,000 of population was higher for the eight chief towns of Scotland during the period 1857-1872, than in the period 1873-1899, the figures being 105, and 70 respectively. For

For Aberdeen during the same periods the [illegible] 65, and 63 per 100,000 of population respe[illegible]

(20) Generally speaking, the smaller towns show [illegible] fluctuation in their annual mortality-rates [illegible] -ing Cough, than do the larger towns. Abe[illegible] the least fluctuation, and Greenock the gr[illegible]

(21) Several towns are frequently visited by hig[illegible] from Whooping Cough in the same year.

(22) Aberdeen shows the next to the lowest avera[illegible] mortality-rate from Whooping Cough per 100,000 [illegible] population, among the chief towns of Scotland. [illegible] rate which is 64, is slightly above that of P[illegible], which is 63. Glasgow shows the highest rate, [illegible] 131 per 100,000 of population.